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RESEARCH PROGRESSES ON GREEN PROPULSION TECHNOLOGY FOR HAN-BASED
PROPELLANT

Abstract

In the area of liquid monopropellant propulsion system, the goal of replacing current highly toxic and easily flammable propellant hydrazine by liquid Hydroxylammonium Nitrate (HAN)—based propellants has drawn the attentions of the relevant industry worldwide. Shanghai Institute of Space Propulsion (SISP) has been focusing on the novel technology since the late 1990s and developing a thruster using HAN-based propellant. The primary objective of using HAN-based propellant is to reduce operational hazards and simplify the propellant transportation and storage compared with the conventional propellant hydrazine. The monopropellant developed by SISP has the same theoretical specific impulse as hydrazine and provides 30% density specific impulse improvement over hydrazine. This paper summarizes the ongoing work and several achievements based on the HAN propellant and related rocket engine technologies. Firstly, more than 20 experimental HAN thrusters have been built and tested in vacuum level, the results from firing tests of these thrusters are presented in the paper, and the Engineering Model of 60-Newton thruster (EM-60) has now achieved more than 1200s accumulated firing time, 1000 pulses and 100s longest continuous firing time with a catalyst bed temperature preheated to 120 degree. It delivers a specific impulse performance of approximately 220s (with 50:1 expansion ratio nozzle) and the highest temperature of the thruster obtained is no more than 1200 degree during thruster operations. Results from the firing tests have validated the thruster design, specific impulse, combustion stability, short pulse capability, and blow-down capability. Secondly, the propellant has been stored for more than 2 years and initial material compatibility screening and testing has also been finished. The current status shows that the HAN propulsion Technology Readiness Level (TRL) 5 has been reached. SISP is preparing a flight program for demonstrating this novel propulsion technology and towards qualified products for space applications in future.